Harnessing Virtual Reality for e-Participation: Defining VR-Participation Domain as extension to e-Participation

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ABSTRACT

The mainstream text-based e-Participation employing blogs, forums, chats and social media enables mass communication and is easy to use and content generated is machine-processable. Nevertheless, the literature points to inherent, significant lack of expressivity in text-based solutions that leads to often distorted or biased communication and misunderstandings. That is particularly evident in widespread hate speech and fake information propagated on social media as part of political discussions. Despite the proliferation of rather-small scale video-teleconferencing online meetings the contemporary digital communication systems still struggle to deliver close to face-to-face group communication experience. Therefore, major government and citizen meetings and hearings have to be held in person if quality results are expected. In fact, our past research showed that decision makers are reluctant to use the social-media-based e-Participation due to lack of meaningful interaction. In our previous work we also showed that leveraging the emerging, affordable and accessible VR technologies for e-Participation creates an opportunity to integrate mainstream channels into more engaged, trusted and more constructive e-Participation experience –VR-Participation. In this paper, we define the domain of VR-Participation as a multi-modal, convergent, immersive communication extending existing e-Participation paradigm. We investigate the current literature coverage relating to the use of Virtual Reality for e-Participation and provide recommendations for further research in the domain.

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CCS CONCEPTS

• **Human-centered computing~Collaborative and social computing systems and tools**

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e-Participation, Virtual Reality, Social media

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1 Introduction

Text has been the principal form of communication employed by Web 2.0-based e-Participation platforms. Primary textual channels include blogs, forums, chats and most importantly social media that gave a promise or e-Participation that is "closer to citizen". Those well-established mediums of communication enable easy and fast information sharing as well as simplified machine-processing. Nevertheless, despite the ubiquity of text communication in e-Participation, literature shows that in cases where certain level of trust is required, textual methods fall short to enable effective communication [5]. The source of the issue is that personal contact employs important non-verbal signaling absent or not adequately represented in digital, text-based communication. Several efforts were made to substitute part of the non-verbal communication in text by adding a simple chain of symbols that remind facial expression such as "similes" and their contemporary, graphical representations known as "emoticons" which introduce so-called quasi-nonverbal cues [14]. However, that form of quasi-nonverbal cues prove to be ambiguous and have strong informal nature that is not suitable for serious e-Participation communication.

Despite all the improvements applied to the textual communication, little progress was made to significantly alter the way people communicate via digital channels (especially social media) at the level of trust derived from social presence that would match the face-to-face communication. In fact, the literature shows that textual communication may be a wrong medium for political meetings leading to political polarization and

lacking constructive results [26]. In particular, the lack of strong sense of presence is pointed as a main reason for ineffective participation in online public meetings. Moreover, due to share size of the communication the information overload [21] is also a substantial obstacle to using social media for e-Participation followed by biased communication, fake news and hate speech often propagated by automated bots through those popular media[1]. The same reason for which social-media are favorite channel for analysis (easy data processing) it is prone for cyber-manipulation[12].

In contrast, video-teleconferencing solutions showed to improve the sense of social presence & derived trust and ensure more explicit communication [24]. Nevertheless, the major obstacle for teleconferencing solutions is the limited support for larger group engagement resulting in very limited adoption and no mainstreaming of teleconferencing for e-Participation. Therefore e-Participation initiatives and e-Participation on social media alike are still limited by predominantly text-based communication with citizens.

The emerging Virtual Reality (VR) technologies, which offer simulated collaborative environments, also often referred to as the form of "telepresence" [28], thanks to high-interactivity, strong immersion, and increased presence capabilities, that gets close to real experience [15], create new opportunities for e-Participation communications. Since VR technologies dating back to 1960s (the introduction of the head-mounted display) made a comeback to the consumer market in form of affordable and immersive VR solutions a new opportunity arises to experiment with more advanced means of communication [4].

The grassroots of VR large group communication started with social virtual reality solutions like SecondLife which created significant disruption in the way online world is perceived. SecondLife showed that many of the real-world scenarios and interactions can be effectively simulated in a computer-generated environment. In particular, cases for online education were explored [6,13]. SecondLife was designed to run on a PC systems where users can interact with 3-dimensionals simulations in a similar manner like in popular 3D gaming solutions. The inherent limitation of that setup is so called "screen barrier" introduced by the computer monitor, causing user to feel less present in the environment simulated [7]. The problem of the "screen barrier" has a tremendous impact on the consideration of Virtual Reality for e-Participation. As we elaborate further in this document, the majority of the e-Participation literature that refers to VR by the means of virtual communities, virtual spaces or collaborative tools refer to either 2D visual interfaces or 3D interfaces that are limited by the "screen barrier".

Since new, widely available Virtual Reality headsets supporting VR manipulating technology emerged (gyroscopic pointers, controllers and gloves) the VR for the first time creates and opportunity to break the "screen barrier" more effectively. The new VR solutions can significantly improve user presence by simulating more effectively the face-to-face interaction experience and go beyond current, rather limited VR use in the domain of online meetings. The availability of immersive features includes the availability of directional and proximity-dependent audio [25] (whispering and directed speech) as well immersive visual all-around-user-wrapping interactive environments [1]. The emerging VR solutions enable high-level of interactivity and manipulation via simulated collaboration tools such as virtual whiteboards, flipcharts, notebooks and presentation screens. That tools combined with real-world-like manipulators in form of movement-tracked pointers and wands that facilitate interactivity with virtual environment create truly immersive and effective collaboration environment [22].

Therefore, since the emerging VR technologies, for the first time since their conception, enable more advanced means of communication by simulating major face-to-face communication paradigms and applying similar, more natural, communication protocols we consider VR as a valid candidate extension to improved e-Participation. In particular, we claim better alignment of the contemporary VR technologies to e-Participation interaction needs with particular emphasis on the case of online public hearing involving online collaboration, co-creation and constructive deliberation. VR technologies for e-Participation have potential to create more immersive, therefore more trustful collaborative environment.

In our previous works we coined the first definition of VR-Participation and provided relevant Communication-Theory-derived model for VR-Participation.

In this paper we attempt further refine our understanding VR-Participation by defining the VR-Participation theoretical space and domain coverage by investigating the literature that tackles the issue of use of Virtual Reality for e-Participation. Based on the theoretical gaps identified we provide a set of recommendations for future research directions required to implement VR-Participation. In particular we focus on methods of evaluation and monitoring of VR-Participation to identify the key requirements for relevant components and capabilities. We finish the paper by providing some early results from brief experimentation in contextualizing the VR-Participation.

2 Research Question

In our previous works, we have coined the concept of vr-Participation as virtual-reality-based e-Participation that by implementing more immersive user-experience provides more effective participant-to-participant communication, hence supporting more trustful and more effective collaboration and co-creation digital space for citizens and decision makers. In that works we have also provided relevant architecture derived from communication theory, structuring the communication in VR-Participation.

By Virtual Reality, commonly referred to as VR we consider totally immersive simulated environments offering a form of strong telepresence and co-presence, where users are isolated from their surroundings as defined by Steuer et al. [28]. Therefore, we do not include broader understood XR – Extended Reality or AR – Augmented reality in the scope of this study.

[1] https://connect.unity.com/p/articles-bringing-online-multiplayer-and-positional-voice-chat-to-gearvr-0 (accessed 8 Sep 2017)

Another, limitation of this study is that we are focusing entirely on the e-Participation technological platforms leaving out the e-Participation as initiative and democratic process aspects.

The research questions considered in this paper is:

- To what extent the use of Virtual Reality for e-Participation is discussed in the scientific literature?
- How to harness the VR-Participation at the early stage?

3 Theoretical Framework

In order to define the coverage of the literature for the use of Virtual Reality for e-Participation we require relevant theoretical framework. In our previous works we leveraged Pepper's World Views [23], to structure e-Participation domain and further works to estimate the required coverage for VR-Participation in terms of communication aspects.

I this paper we built our framework by combining basic "world views" on Virtual Reality driven e-Participation and Virtual Reality use in e-Participation perspectives.

3.1 Basic Views on vr-Participation

Pepper identified four different adequate views of the world: Formism, Mechanism, Organicism and Contextualism [8]. He described each of the four views as follows [8], [19]:

Formism – the root metaphor for this view is a similarity. It can be understood as an entity- or forms-based view. In our framework, this view represents all the entities involved in and associated with the use of Virtual Reality for e-Participation like basic concepts and assets.

Mechanism - the root metaphor for this view is that the machine is composed of discrete parts related to one another in a systematic way. In our context this view represents all the capabilities and functions that are brought by Virtual Reality to e-Participation.

Organicism – the root metaphor for the third view is the process of organic development. Organic development is described by staged-growth, maturity or level-based models. In our context, this view represents the consideration of the specific goals and aims set for Virtual Reality in e-Participation.

Contextualism – the root metaphor for this view is an ongoing act. Two basic concepts are central to contextualism: 1) "quality" represents the experienced nature of the act and 2) "texture" refers to the details and relations that make up the quality of the act. In our context, this view represents all the means of evaluation of performance of Virtual Reality driven e-Participation. In the context of VR-Participation, Pepper's Views enable structuring of the extension of e-Participation through some specific Virtual Reality methods, hardware and software goals (Organicism); the description of different entities involved in realizing a specified VR-Participation capabilities (Formism); the different functions, processes and systems required to produce desired outputs or outcomes (Mechanism); an indication and evaluation of the experience of participants of the vr-Participation system (Contextualism).We believe that Contextualism is the most important View at the early stage of the domain. The development of VR-Participation that will be effective and provide more engaged and trusted e-Participation is contingent on the constant evaluation and improvement all the building components and capabilities (Formism and Mechanism) deployed and revisiting the goals (Organicism) of the Virtual Reality-driven e-Participation. The basic relations among the four views are as follows: The Mechanism view specifies operations and actions to achieve goals specified in the Organicism view. The Formism view specifies entities and forms that participate in operations and actions specified in Mechanism view. Similarly, entities and forms specified in the Formism view define different contexts in the Contextualism perspective which contribute to the Organicism view. These relations are shown in Figure 1.

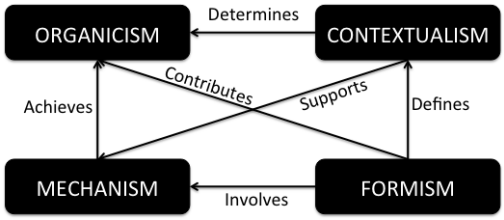

Figure 1: Views of the World as presented in [18]

3.2 Virtual Reality for e-Participation use perspectives

In our framework, we consider three basic perspectives on vr-Participation: 1) Methods of employing VR for e-Participation 2) Virtual Reality hardware used for e-Participation 3) Virtual Reality Software used for e-Participation including online services and applications. The relations between the perspectives are visualised in Figure 2. The specific methods of using VR for e-Participation can be only applied if they are enabled and supported by specific hardware and software capabilities. Software can implement some very specific methods but must be hosted and powered by relevant hardware components.

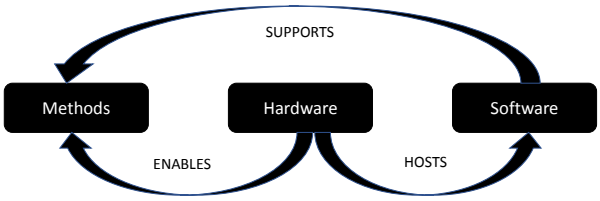

Figure 2: VR for e-Participation use perspectives

3.3 Integrated Framework for structuring the vr-Participation domain space.

In Table 1 we resent our Integrated Framework for structuring the vr-Participation domain space. The framework is composed of

two axes. The vertical axis divides the space by four basic views of the world (according to Pepper); while the horizontal axis divides the space by three Virtual Reality for e-Participation (VR-Participation) perspective. Every cell includes a general description of the scope of VR support for e-Participation for given parameters.

Table 1: vr-Participation Domain Space Framework

Generic Views	vr-Participation Perspectives		
	Methods	Hardware	Software
Formism	Basic artefacts of Virtual Reality for e-Participation including Avatars, Virtual Spaces, Virtual Tools	Virtual Reality Components such as Headsets, Manipulators, Servers	Major Software Components such as interactive platforms, social VR platforms and artefacts implementations (specific avatars, implemented spaces)
Mechanism	Specific Activities possible such as walking, gazing, talking, pointing, non-verbal communication, interacting with objects	Hardware Capabilities Provided by VR supporting e-Participation such us, head-tracking, hands-tracking, walking-tracking, voice recording	Software features provided by VR supporting e-Participation: such as voice communication, non verbal communication, file-exchange, slide presentation
Organicism	Specific e-Participation goals realised via Virtual Reality such as immersive engagement supporting more trustful communication or easy co-creation and collaboration on 2d and 3d material as well as easy discussion publishing and live-streaming to social media.	Specific VR hardware features that support realisation of e-Participation goals, that would include the VR headsets and hardware platforms (PC, Servers) which enable immersive and trusted participation	Specific VR software features that support realisation of e-Participation goals, that would include the discussion moderation capabilities, voting options, co-creation and collaboration – 3d and 2D co-drawing or social media publishing and video-streaming integration.
Contextualism	Methods supporting evaluation and monitoring of the e-Participation in Virtual Reality	Specific hardware that enables monitoring of e-Participation in Virtual Reality. That would include specific servers, tracking devices and sensors	Specific software that enables monitoring of e-Participation in Virtual Reality. That would include specific user monitoring services, heat map generation, user-to-user and user-to-tool patterns analysis tools.

4 Methodology

In our methodology we have applied two basic methods. First, we have applied the desk research method and queried the well-established scientific database SCOPUS [2] using the following queries:

- "Electronic Participation AND "Virtual Reality"
- "e-Participation" AND "VR"
- "e-Participation" AND "Virtual Reality"
- "e-Government" AND "Virtual Reality"

Based on the results returned by the database we have used the list of papers and mapped it over our analytical framework to define the current domain space coverage for VR-Participation.

We are aware of extensive use of VR in education, training and other domains however in this work we focused on the exact and explicit use of Virtual Reality for e-Participation.

5 Analysis

Now we are leveraging the analytical framework constructed in this document to identify the literature coverage for the use of Virtual Reality for e-Participation. As discussed in the methodology, we have queried the SCOPUS database in order to fetch relevant publications. The first query- *Electronic Participation AND "Virtual Reality"* returned no documents. The second query – *e-Participation" AND "VR"* returned only three documents, and all results were works by the authors of this paper. The third query - *e-Participation" AND "Virtual Reality"* returned 8 results in total. After subtracting author's publications, we trimmed the results to 5 documents. After we analysed the scope of the documents only 4 documents appeared to be related and that included the works by: Maciel et al. , Martin et al. , Salviero et al. and Bailey at al. [2,17,20,27]. All four documents however did not relate explicitly to the use of Virtual Reality in e-Participation as expected. In fact, none of them related to Virtual Reality per se. The reason why SCOPUS database returns those

[2] https://www.scopus.com

papers is the extended keyword indexing linking Virtual reality to concepts like Virtual Community and Virtual e-Participation spaces that are mentioned explicitly by the authors. However, all those papers relate to word *virtual* in a very different sense to the concept considered in this paper. The authors understand Virtual as digital platforms in general, in particular social media, while our definition is in line with the one relating to *Virtual Worlds* definition given *by Bell et al.* [3] presented as: *A synchronous, persistent network of people, represented as avatars, facilitated by*

Finally, we applied the last query to the SCOPUS database - *"e-Government" AND "Virtual Reality".* We have received a list of 78 documents. We analysed the abstracts and again, the documents were not related to Virtual Reality and e-Participation in our understanding of the terms. Since we have learned that Virtual Reality "mistaken" correlation comes from the automated indexing extension we limited the Keyword "Virtual Reality" only to original keywords provided by the authors by using the following query: *(TITLE-ABS-KEY ("e-Government" AND "Virtual Reality")) AND (authkey "Virtual Reality")* That query, however narrowed down the scope of the document listed to none. In order to boost the reach of the papers we leveraged the "less scientific" Google Scholar database.

This way we have encountered two more papers by Magoulas et al. [18] and Heldal I. [9] both published in 2007. In the case of the first, short paper, authors look very briefly on the use of Virtual Reality for e-Government and engagement of citizens in decision-making as a concept and discusses the VR as a near future (no study or empirical evidence). In particular listing obstacles to using VR such as affordability and performance of the hardware. Therefore, that paper provides rather highlights of using VR for e-Participation in the future and again fits the same Organicism / Method cell even though authors try to formulate some generic requirements to hardware and software however without any particular theoretical o technological backing.

The next paper deals with using the Road Planning Virtual Simulation and Virtual Models, for better engagement of citizens in planning and decision making. That approach however does not include the use of Virtual Reality Immersive Environment for exploration but rather simulation and use of standard PS & screen setups. Therefore, that paper again fits the Organicism / Method cell in our framework with partial coverage of the Formism and Mechanism Cells for Software view.

We argue that the low recall of papers strictly relevant to our definition is correct considering that the affordable Virtual Reality headsets that could support any form of e-Participation in broader sense, have been released to consumer market and mainstreamed starting just in 2015 and 2016 with arrival with PC-powered Oculus Rift (2016) and mobile-powered Samsung Gear VR (Nov 2015). Therefore, any previous elaborations are based either on non-immersive Virtual Spaces or 2D environments as discussed in the papers recalled. Therefore, we claim that defined in this work VR-Participation is a new emerging domain of low domain literature coverage to the date.

More recent papers such as the work by Jiang et al. [10,11] (2016 and 2018) and Lv et al. [16] (published in 2018) again present the view on Virtual Reality as interactive simulation that is presented online via browser, not as immersive environment. In the latter paper authors argue that VR headset can be used to explore the interactive visualizations however the paper is focused on GIS visualizations for Government applications (smart cities) not on VR interactivity and immersive collaboration between users. The first paper in particular stresses on the importance of online Virtual Reality services and explores the importance of spatial surround sounds to be represented via browser for better acoustic planning in the city. Therefore, the two works again stress on the use of virtual simulations used by government and citizens for better decision making however not deal with immersive Virtual Reality environments but leverage the "window" of the PC or mobile screen to engage citizens and government. Those papers again cover the Organicism / Method cell and Formism and Mechanism Cells for Software view. In the Table 2 we present the explicit mapping of the papers discussed to our framework.

Table 2: Domain Literature Coverage

Generic Views	vr-Participation Perspectives		
	Methods	Hardware	Software
Formism			Heldal I. Jiang et al. Lv et al.
Mechanism			Heldal I. Jiang et al. Lv et al.
Organicism	Maciel et al. , Martin et al. , t al. and Bailey at a. Magoulas et I. Jiang et al.		
Contextualism			

Figure 3: VR Experimentation I The mapping presented corroborates visually the little coverage of the literature for the use of Virtual Reality for e-Participation as VR-Particiaption. In particular, based on the desk research investigation we have shade-coded the gaps. Some of the papers identified as related address mainly the Organicism/Methods cell of our framework and that is also to limited extent since none of the papers addresses literally the Immersive Virtual Environments therefore, they do not consider many of the e-Participation goals that VR could support. Moreover, the papers that promptly identify some key software components, tools and capabilities again provide a very narrow subset of the tools required for VR-Participation.

The immediate conclusion from our analysis is that extensive further research is required to define and evaluate relevant VR methods, VR hardware and Virtual Reality software tools that could support VR-driven e-Participation solutions.

Nevertheless, we believe that extensive experimentation with citizen users and government users engaging through VR-technologies is required to first address the Contextualism gaps. The arranged experiments, monitoring and evaluations are key to harnessing the VR-Participation and identifying the key technological components and capabilities required to implement e-Participation more effectively within immersive Virtual Environments.

6 Public Experiment

To corroborate our findings and to satisfy the first step in covering the VR-Participation domain space from the Contextualism side we have arranged an early e-Participation VR-experiment where citizens and decision makers could interact in immersive Virtual Space. The aim of the experiment is to observe and analyse decision-makers and citizens interacting and collecting their feedback on the use of immersive Virtual Reality for e-Participation as they interact via VR medium.

To setup our experiment, we have used five VR headsets and hosted a panel discussion on the use of VR for serious applications. The experiment was performed on the following hardware: 1 x Oculus Rift running on Alienware Windows Laptop, 1 x Oculus Go and 2 x Samsung Gear VR platform.

Figure 3: VR Experimentation

An experienced e-Participation researcher was entrusted preparing relevant hardware & software infrastructure for the early engagement. We used the Alienware PC & Oculus Rift hardware to set a Virtual Reality space & advertised an online public event via popular cross-platform social-VR software application - AltspaceVR[3]. The choice of AltspaceVR (AVR) platform was dictated by our previous state-of-the art investigation in which AVR emerged as the only large-group social-VR solution to be currently available for all major platforms: 1) Desktop 2) Mobile 2D, 3) Major mobile VR and PC-connected headsets. That is particularly important in terms of accessibility and inclusion in digital participation. AVR platform ensures inclusion of wide spectrum of digitally enabled users that can engage through the newest VR technologies as well as through legacy 2D interfaces (offering similar experience to SecondLife interface) on PC or mobile devices. The extra motivation for choosing the AVR platform was recent experiment with serious communication in banking sector in Ireland[4]. The argumentation given by the bank for using AVR for the first experiments with VR serious discussions corroborate our findings presented in the background sections. Moreover, AVR platform has a nature of a sandbox and Software Development Kit (SDK) that can be easily modified and extended to severe some specific meeting scene arrangement needs. AVR users can interact with the world and with other participants thorough special Avatar figures that can be easily customized to remind the specific person. Moreover, AVR provides an easy 3D space editor where any Virtual World can be modified, or entirely new Virtual Space can be created to satisfy specific interaction needs.

Once both the hardware and the software were set we begun the experimentation.

The meeting involved one host (e-Participation expert) and four individuals participating in the debate:

1) Former Senator and Mayor – talking about the use of VR for politics and political debates
2) Community Leader – talking about citizen engagement via VR,
3) Social Software Research Leader - talking about the use of VR for co-creation and collaboration
4) Interactive Visualization Expert Researcher – talking about data-driven discussions in VR such as collaborative spatiotemporal planning.

The meeting was open to the public via the AVR Events publishing platform and few citizens attended the meeting. In Figure 3 we present some of the VR photos taken during the experimental engagement. The AVR platform enables taking pictures in virtual reality via simulated "selfie tools". Moreover

[3] https://altvr.com/
[4] https://www.wsj.com/articles/virtual-reality-takes-on-the-videoconference-1474250761

live-streaming and recoding of the events is possible via external tools.

The immediate, brief results from the experiment, coming as a direct feedback from the participants, were the following:

- VR can effectively be used by senior politicians & community leaders without prior VR technology experience
- Participants are focused on the discussion due to complete immersion
- To benefit from the VR immersive environment, relevant interactive tools must be developed – the classic slideshow and presentation appeared as a "waste" to the participants. In particular participants preferred to go and explore spatially the VR environment rather than watching presentations on virtual screen. That fact is particularly important when spatial planning is discussed. Participants would rather explore the 3D models.
- VR-headsets are essential for the participants to connect better with the discussion ("screen participation" indeed does not provide enough immersion). Therefore immersive, trusted VR-Participation is contingent on availability of Virtual Reality headsets hardware.
- Moderation features were pointed as important to ensure smooth conversation
- Easy import and manipulation of GIS and 3D shapes and simulated environments into VR for collaborative analysis and co-creation was considered as one of the potential key advantages of VR-Participation over any other means of e-Participation.
- The use of avatars can help to avoid biased communication (discrimination based on gender, ethnicity or religion) while not limiting the expressiveness of communication
- A VR-Participation training sessions should be organized prior e-Participation engagements.

7 Discussion

In this paper we have provided an introduction to the topic of the use Virtual Reality for e-Participation. Specifically, we presented some of the current e-Participation platforms' challenges that are related to the textual communication medium applied. We showed that those challenges are further propagated and even magnified by social-media-based e-Participation. We have highlighted the potential advantages of VR-Participation as an extension to text-based e-Participation in terms of enabling more trustful communication. We have provided relevant analytical framework and defined the domain space of VR-Participation and analysed the existing literature dealing with explicit use of VR for e-Participation. Our investigation showed that there is very limited coverage of the literature dealing with immersive Virtual Reality use for e-Participation. The majority of the studies focus on virtual environments that can be explored by users only via 2d-screen interfaces of their computers or mobile devices and elaborate upon methods a tool that can be applied to online and social media services. Therefore, we argue that VR-Participation is a new domain of very limited literature coverage to the date and further studies on the use of immersive Virtual Reality for e-Participation are required.

We also argue that in order to harness Virtual Reality for e-Participation, the extensive research works should first focus on contextualising VR-Participation by providing relevant methods and tools for VR-interaction monitoring and analysis to identify key components and capabilities that can extend the existing Virtual environments with features and tools that will enable effective e-Participation. The major limitation of this study is the narrow scope of the investigation; we focused only on the literature that is explicitly dealing with VR for e-Participation. We are aware of the extensive work in the use of VR for training, education and health sector and other domains that are beyond the scope of this investigation.

8 Conclusions

To satisfy the first step in defining the VR-Participation domain we have constructed relevant theoretical framework and investigated relevant literature dealing with the use of immersive Virtual Reality for e-Participation. Our study showed very limited literature coverage of the domain to the date and a strong need for further research in particular in contextualising VR-Participation, experimenting and evaluating citizen and government interactions in Virtual Reality to identify the key capabilities and tools to support effective e-Participation in VR. Future work will involve preparing relevant experimentation infrastructure and subsequent VR-sessions involving citizens and decision makers. In particular we intend to develop relevant monitoring methods, frameworks and tools that will enable us to elicit specific behavioural patterns that can inform the design of the future VR-Participation environments and tools. An iterative process that spans from the Contextualism level of our theoretical framework should enable us to gradually address all the cells at first the Organicism level by specifying high-level goals and then at Formism and Mechanism levels by identifying specific tools and capabilities that are required to convey effective e-Participation activities within immersive Virtual Reality environments.

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